P03: Possibilities of 4D Energy-filtered STEM for Core Loss Spectroscopy

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4D STEM is rapidly gaining popularity for many investigations, from orientation mapping to the probing of atomic electric fields. In this work, we investigate the possibilities of combining 4D STEM with core-loss EELS, i.e., performing 4D EFSTEM.

Energy-filtered diffraction patterns in general record the momentum distribution of the probe beam after an inelastic scattering event. Apart from elastic channeling effects, they can essentially be modeled as a convolution of the incident wavefunction (in momentum representation) with one or more scattering kernels, which in turn are derived directly from the electronic states in the sample (see fig. 1). Energy-filtered diffraction using an incident plane wave was used to investigate the scattering kernels (in particular their anisotropy and radial dependence) but inherently lacks spatial resolution and, therefore, requires a (nearly) perfectly crystalline sample.

Combining energy-filtered diffraction with STEM allows to exploit the best of both worlds: it features the high spatial resolution of STEM, while simultaneously providing the multitude of additional information beyond conventional (inelastic) imaging that energy-filtered diffraction has to offer. With modern, fast, pixelated detectors and the existing algorithmic arsenal of 4D STEM, 4D EFSTEM holds great promise for enabling new insights into physics and material science on the atomic scale.

The authors acknowledge financial support by the Austrian Science Fund (FWF) under grant nr. I4309-N36

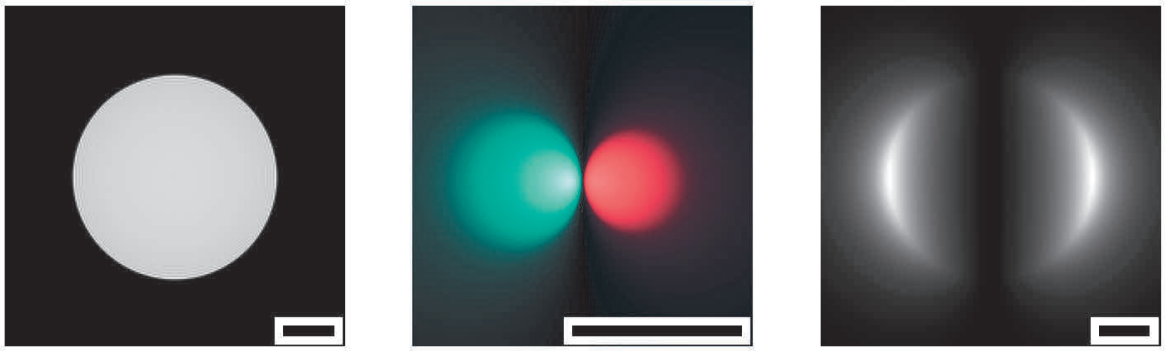

Fig. 1: Reciprocal space representation of an incident STEM wave (left), an inelastic scattering kernel (middle), and the corresponding outgoing wave function (right)

Poster P03 *Thu. 17:00-18:00*